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species and varieties are described, and that "the total number represented in the Yosemite National Park is considerably greater, since the grasses, sedges and rushes are here omitted." The omission of the grasses and related plants is probably justified since the book is planned primarily for the amateur and tourist, but without them botanists and foresters interested in the grazing problems of the Sierra Nevada will find the book seriously lacking.

Turning with a more critical eye to the text we find carefully worked out keys to the genera and species which will add much to the usefulness of the book. In the descriptive part emphasis is placed upon the species. The generic and family descriptions are brief, or when represented by a single species omitted entirely. In the conception of generic and specific lines the authors have been very conservative. They recognize, for instance, only one rose, which they term *Rosa californica*; as a matter of fact there are two roses in the region, neither of which, in our opinion, is typical *R. californica*. Again, *Castilleja parviflora* and *C. miniata* are included although students of the genus have long since recognized the Sierra Nevada plants as distinct from those northern species. Of course these are not serious defects, especially in a book planned for the amateur. The plant geographer, however, must needs be on his guard in using it for gathering data on plant distribution. But in many regards the "Yosemite Flora" is the best book that has appeared on the California flora since the "Botany of California." And although it nominally covers only a small section of the Sierra Nevada it will be found very useful throughout the mountain range.

L. R. ABRAMS

GAGER'S REVIEW OF PAYNE'S LABORATORY MANUAL OF EXPERIMENTAL BOTANY.—A REPLY

The review of Payne's Manual of Experimental Botany for high schools contributed by Dr. Gager in the June *TORREYA* interested me considerably for two reasons: first because of my personal acquaintance with Mr. Payne, whom I know to be

a very successful teacher of high school botany, and second because I find in his text as published the method of approach which makes his work successful. It seems to me that in a review of the length of Dr. Gager's—three pages—the good points of Mr. Payne's book deserve more than a six line paragraph, and I hope in the following discussion to show reason for this opinion.

Dr. Gager's review begins with a criticism to which it seems to me strong objection may be raised in point of fact.

This relates to the general plan of the text in which Dr. Gager finds as one of the main weaknesses of the book "that botany is continually correlated with practical gardening, farming, and bacteriology." And further, to quote the reviewer, "Undoubtedly the movement to introduce the study of the principles of agriculture into secondary schools is a movement in the right direction, but why agricultural matter should be eternally mixed in with botany until the latter science loses all semblance of its real self, it is difficult to comprehend."

It appears to the writer that Dr. Gager's objections to correlating theoretical and practical plant study must have arisen from a misapprehension of the purpose of Mr. Payne in such correlation. One of the main difficulties in teaching elementary botany in high schools lies in finding an approach to the student which shall have interest for him, and ready connection with his previous knowledge. The experimental method of Mr. Payne's text-book is admirable for securing the pupil's interest, and the continual references to what may be spoken of as the applied phases of botany serve to clinch the facts in the pupil's mind as well as to explain the reasons for many common phenomena and their relation to plant life. And further the only facts about plants possessed by the ordinary city boy relate to their uses as food, drugs, lumber, clothing, etc. A country boy has additional knowledge of living plants and agricultural processes. Mr. Payne has endeavored to make useful this fund of knowledge by frequent references to the uses of plants and their culture in connection with the purely botanical study of the structure and function of typical plants. It is, of course, not to be expected

that all the exercises are as equally useful in the city as in the country, but they are in number sufficient to allow for the selection of an ample year's course in either situation.

There is another reason why a course designed to correlate theoretical and applied plant study is very timely. The majority of high school pupils who enroll do not finish half the high school course, much less enter college. The purely theoretical course in botany, along the lines laid down by the college entrance committee, has little more than a slight disciplinary value for the ordinary high school pupil. A high school course in botany which is designed mainly to prepare for college requirements is in the same class with the high school Latin work which is or used to be designed to prepare the student eventually to enjoy reading classical Roman literature in the mother tongue.

Botany for botany's sake is no longer an issue for the high school curriculum. Mr. Payne's text represents a step in the direction of a practical course for high school pupils. The value of the entire course as outlined can be determined only by actual use, but, it may be stated, much of it has already proved its value in first year high school work.

With respect to other criticisms which Dr. Gager has made which have to do mainly with details of accuracy and completeness, many of them are probably justified but even some of these are more or less excusable as inherent in the plan of the book.

The book consists almost entirely of exercises directing the pupil's observation and requiring some constructive thought on his part in carrying them out. The exercises cover, in the course of the book, the entire field of botany, the arrangement of matter being in general like that in most elementary texts. Scattered along in connection with the exercises are occasional brief notes which constitute the didactic matter of the book. The information given in these is such as could not possibly be learned by the inquiries of the pupil. The teacher is thus afforded full opportunity to lead the pupil to derive for himself the conclusions and generalizations proper to each exercise. The few definitions given are such as the pupil might be led to construct from the work done, and which he can entirely com-

prehend. They are thus liable to be somewhat incomplete and inaccurate, but the more complete and accurate definitions of most texts have the disadvantage of being only partly comprehensible as a result of class room work, the acquisition of the remainder being purely memory work.

Mr. Payne's book thus calls for a minimum of teaching by authority and a maximum of self-help by the pupil. In this method a much greater responsibility rests with the teacher but the results should more than compensate.

In conclusion brief reference may be made to another recent review of Mr. Payne's book (Bessey, C. E., *Science* II. 35: 994. 1912). Prof. Bessey's main criticism is that the book follows too exclusively the single method of approach, the experimental. This fact finds its main defence, as noted above, in the purpose of the book to teach by the pupil's endeavor rather than by that of the teacher. The lack of expository matter certainly has some drawbacks but it seems to be a necessary defect of the virtues of the book. The ideal text will perhaps have the loose-leaf system, with experiments and expositions separate so that the pupil need not be given the latter until his work with the former is complete.

Another fault noted by Prof. Bessey has to do with the repletion of exercises, too many to be covered for a year's course, but he also finds much to commend in the form and matter of the exercises and suggests that teachers may with profit use the book as a source from which to draw experiments as needed.

It is to be hoped that Mr. Payne's book may receive the thorough working out to which, with its many merits, it would seem to be entitled. Defects it has without question, but these are mainly minutiae which can easily be rectified. The ultimate value of the plan and method can only be determined by the test of actual use.

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